STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
COOKEVILLE ENVIRONMENTAL FIELD OFFICE
DIVISION OF WATER RESOURCES
1221 SOUTH WILLOW AVENUE
COOKEVILLE, TN 38506
PHONE 931-432-4015 STATEWIDE 1-888-891-8332 FAX 931-432-6952

The Honorable Jimmy Wheeler
Mayor City of South Carthage
106 South Main Street
South Carthage, Tennessee 37030

February 25, 2015

RE: Compliance Evaluation Inspection (CEI), South Carthage, Smith County; Sewer Collection System Power Usage Study with regard to the Inflow and Infiltration of Stormwater; SOP # 91209, Permit Expiration: April 30, 2017

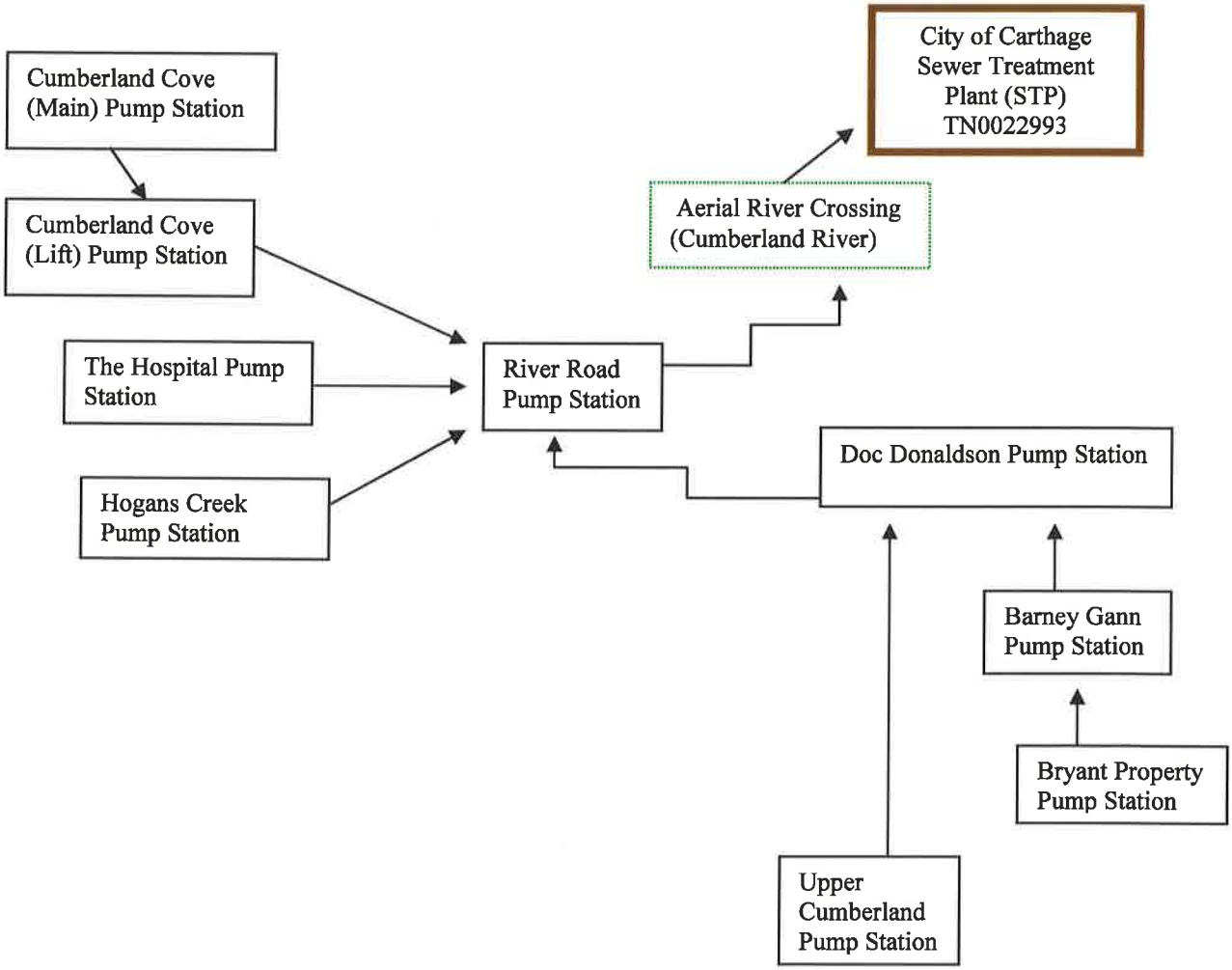
Dear Mayor Wheeler:

Division of Water Resources staff wishes to thank you, Mr. Shane Fann, Mr. Randall Thompson, and Ms. Wanda Geho (Upper Cumberland Electric Membership Corporation) for your generous time and courtesy during the recent Compliance Evaluation Inspection (CEI) and sewer collection system power usage study regarding the cost of inflow and infiltration, often referred to as "I and I", of stormwater.

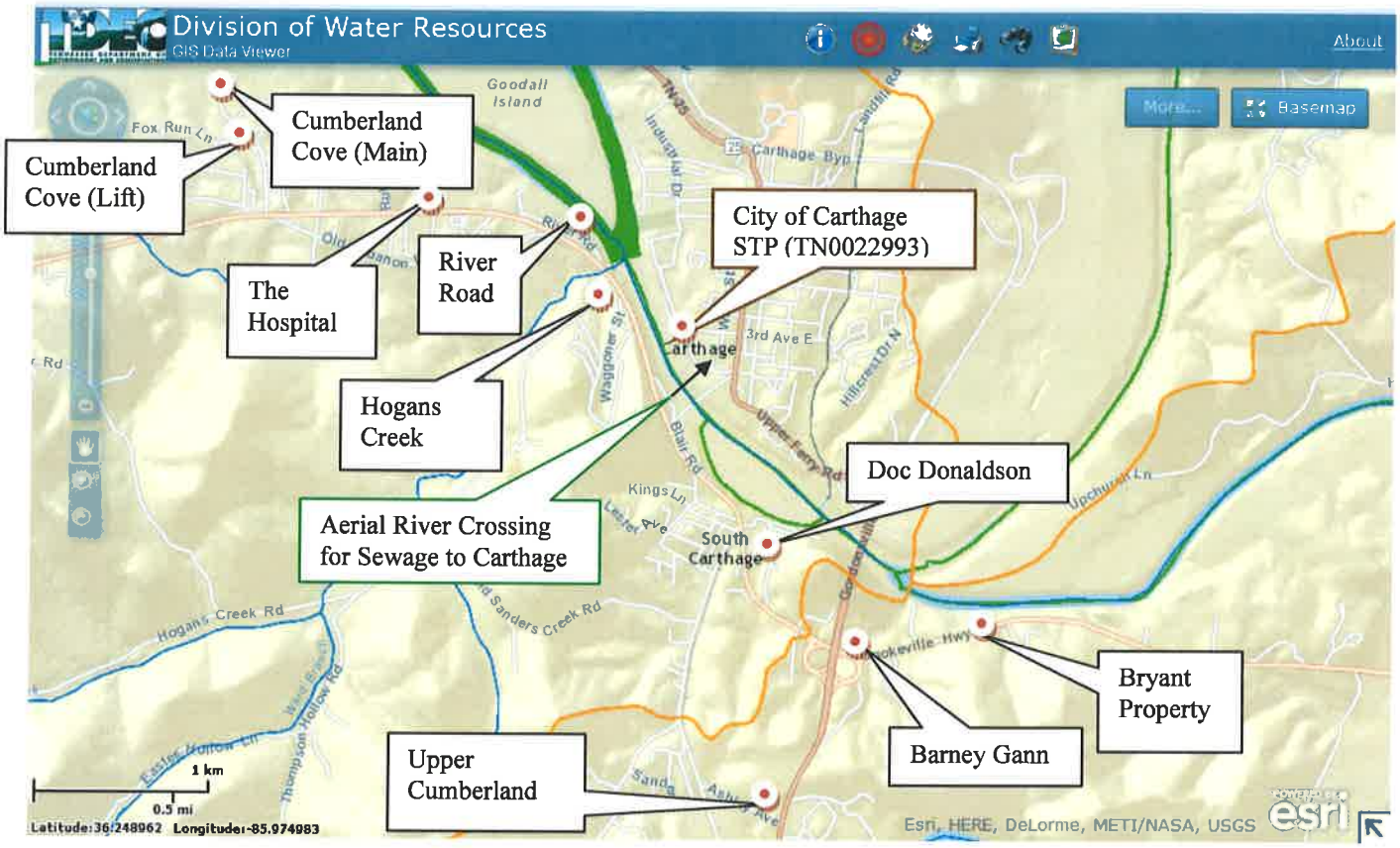
Nine (9) sewer collection system pump stations were reviewed within the City of South Carthage's sewer collection system. These nine pump station locations have separate electrical meters for measuring power usage in kilowatt hours, (kWh). The power provider, Upper Cumberland Electric Membership Corporation (UCEMC) utilizes automatic meter reading (AMR) technology as part of an Advanced Metering Infrastructure (AMI) within this region. The meters with the installed transponders, sometimes referred to as smart meters, can provide detailed real time data for several parameters: power consumption, time of use, power factor, and voltage readings. The data can be easily accessed through an internet connection.

Rainfall data for the Smith County, City of South Carthage area was provided by the Tennessee Valley Authority (TVA). This data was collected by an automated rain gauge located in close proximity to South Carthage and the Cumberland River.

The South Carthage sewer collection system is depicted in the flow chart below. The pump stations and the related piping connections within the drainage area are referred to as the "sewershed".

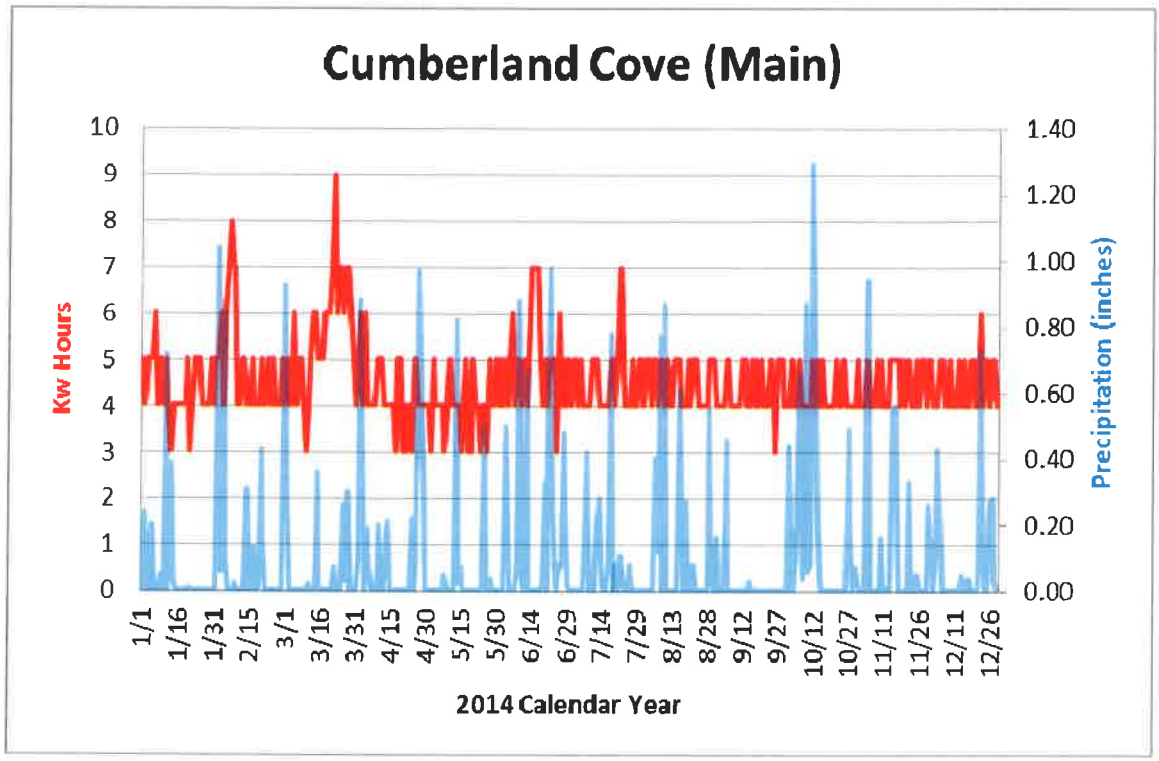


The Doc Donaldson Pump Station requires the most energy. Its geographic location requires that it transports sewage a considerable distance relative to the locations of the other pump stations. The River Road Pump Station transports all the sewage across the Cumberland River at the Carthage Bridge to the City of Carthage Sewer Treatment Plant.



The above map depicts the geographic locations of the City of South Carthage's sewer pump stations. To reiterate, sewage is pumped across the Cumberland River at the historic Carthage Bridge to the City of Carthage Sewer Treatment Plant.

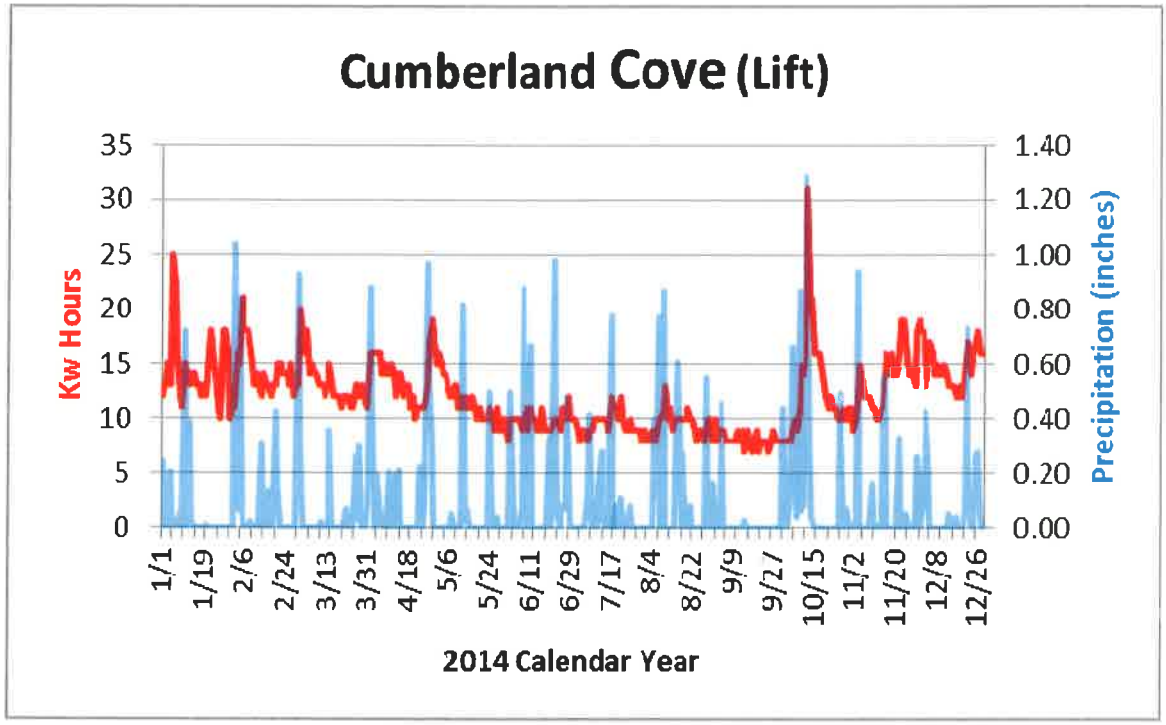
The nine (9) Pump Station's base line flows are estimated during the Month of September when less frequent rain events and smaller volumes of precipitation have ocurred.



The Cumberland Cove (Main) Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014. In other words, this graph illustrates electrical costs associated with the inflow and infiltration of stormwater into the city's sewer collection system.

The electrical data was obtained through the AMI technology provided by UCEMC. The expected baseline power usage for this pump station without the influence of stormwater (minimal usage or base flow electrical requirements) would average 4 kWh (daily). As seasonal precipitation changes, the required electrical power usage varies.

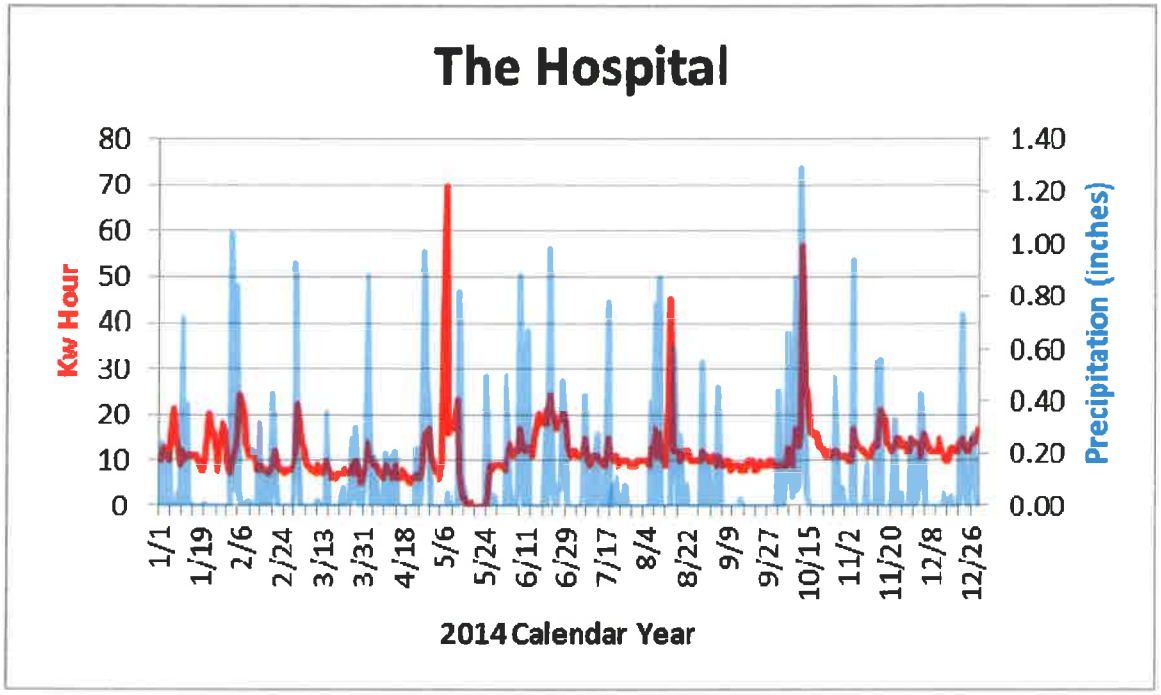
The total power usage in kWh for this pump station during the illustrated time period was 1,652 kWh. Assuming that the pumps would use only 4 kWh hours per day if inflow and infiltration were eliminated from the sewer collection system, the power usage would then be estimated at 4 kWh x 365 days which equals 1,460 kWh for the year long period. A difference of 192 kWh is the estimated result. The stormwater pumping percentage: 11.3 %.



The Cumberland Cove (lift) Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014. Again, this graph illustrates electrical costs associated with the inflow and infiltration of stormwater into the sewer collection system.

The electrical data was obtained through the AMI technology provided by UCEMC. The expected baseline power usage for this pump station without the influence of stormwater (minimal usage or base line electrical requirements) would be 8 kWh per day. As seasonal precipitation changes, then the required electrical power usage varies.

The total power usage in kWh for this pump station during the illustrated time period was 4,403 kWh. Assuming that the pumps would use only 8 kWh hours per day if inflow and infiltration were eliminated from the sewer collection system, the power usage would then be estimated at 8 kWh x 365 days which equals 2,920 kWh for the year long period. A difference of 1,483 kWh is the estimated result. The stormwater pumping percentage: 33.68 %.

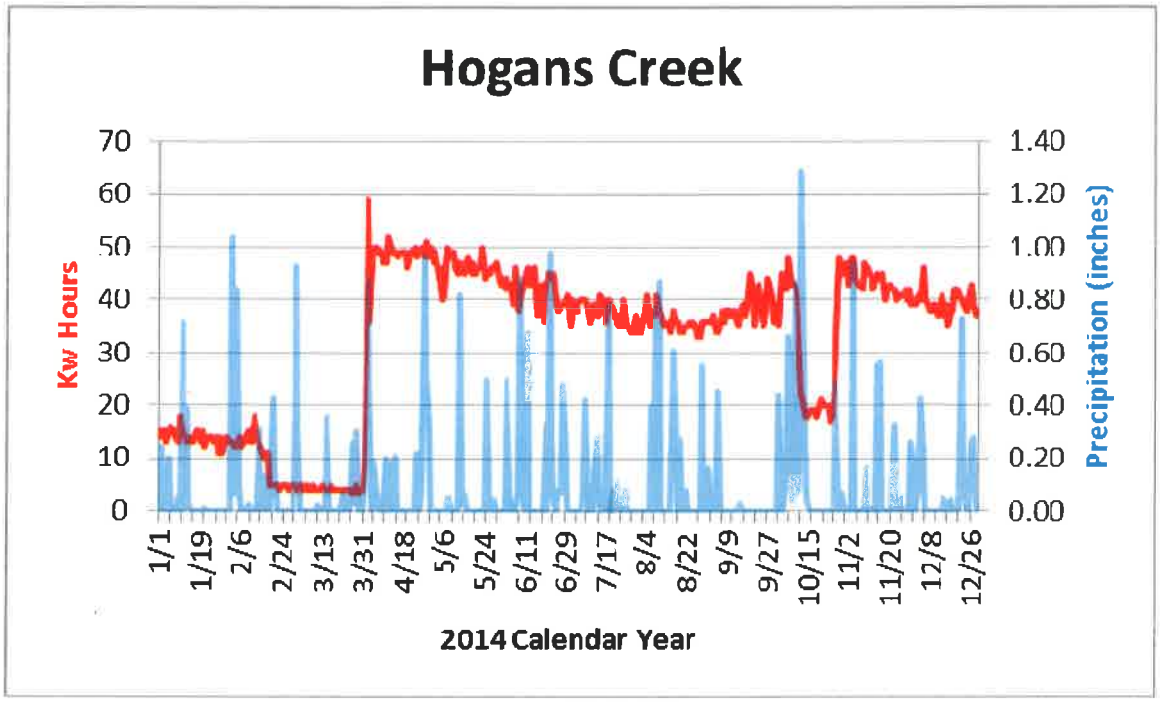


The Hospital Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014. Again, this graph illustrates electrical costs associated with the inflow and infiltration of stormwater into the sewer collection system.

The electrical data was obtained through the AMI technology provided by UCEMC. The expected baseline power usage for this pump station without the influence of stormwater (minimal usage or baseline electrical requirements) would be 9 kWh per day. As seasonal precipitation changes then the required electrical power usage varies.

The total power usage in kWh for this pump station during the illustrated time period of 365 days was 4,241 kWh. Assuming that the pumps would use an average of 9 kWh per day if inflow and infiltration were eliminated from the sewer collection system, the power usage would then be estimated at 9 kWh x 365 days which equals 3,285 kWh for the year long period. A difference of 956 kWh (4,241 kWh – 3,285 kWh) is the estimated electrical power used to pump stormwater from this pump station for the January 1, 2014, through December 31, 2014, time period. The stormwater pumping percentage: 22.5 %.

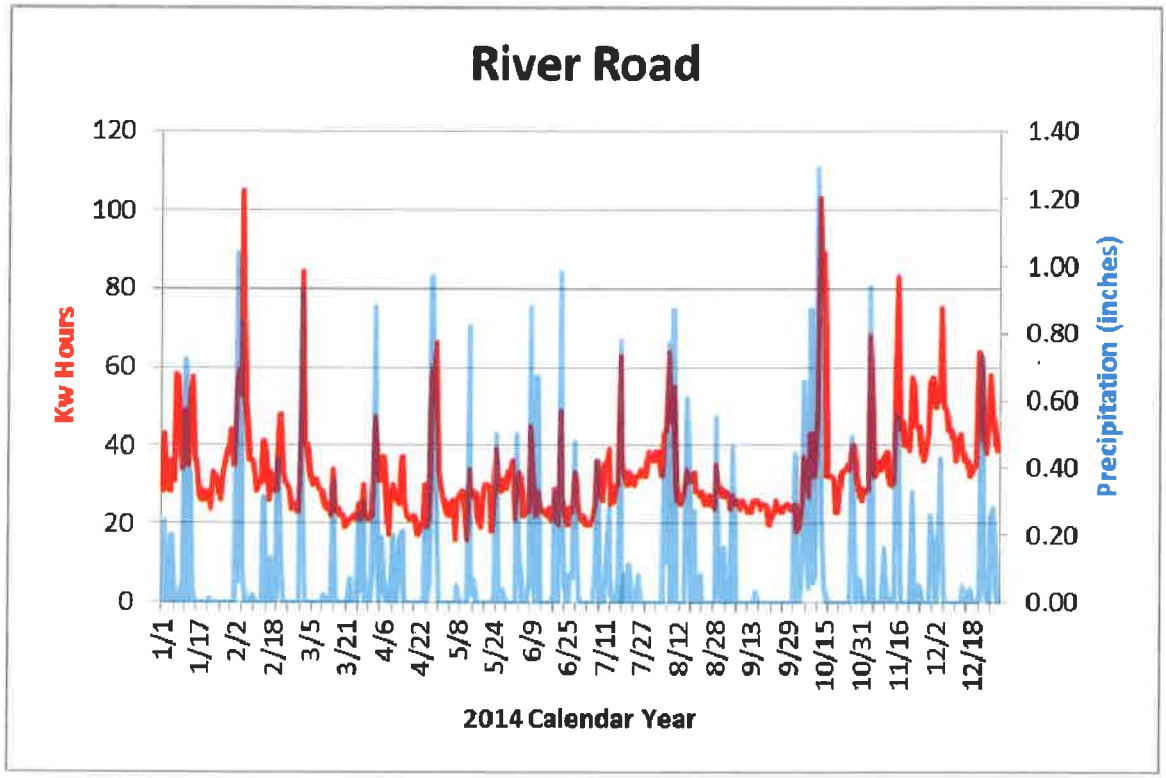
Reviewing the graph it is noted that during the fall and early winter electrical kWh peaks may have been reduced due to maintenance activities around the pump station. The activities included the sealing of manholes and rehab on the pump station.



The Hogans Creek Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a poor correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014.

The electrical data for this pump station was disregarded. It has been noted by the Mayor and the Collection System Operators that the Utility has been having some problems with the metering at this particular service location.

The Hogans Creek Pump Station has remained operational. It will not be considered as part of the power usage study due to the unusual circumstances regarding the electrical data. It is important to review and document the graph in order to illustrate how the Automated Metering Infrastructure was used to recognize a possible problem.

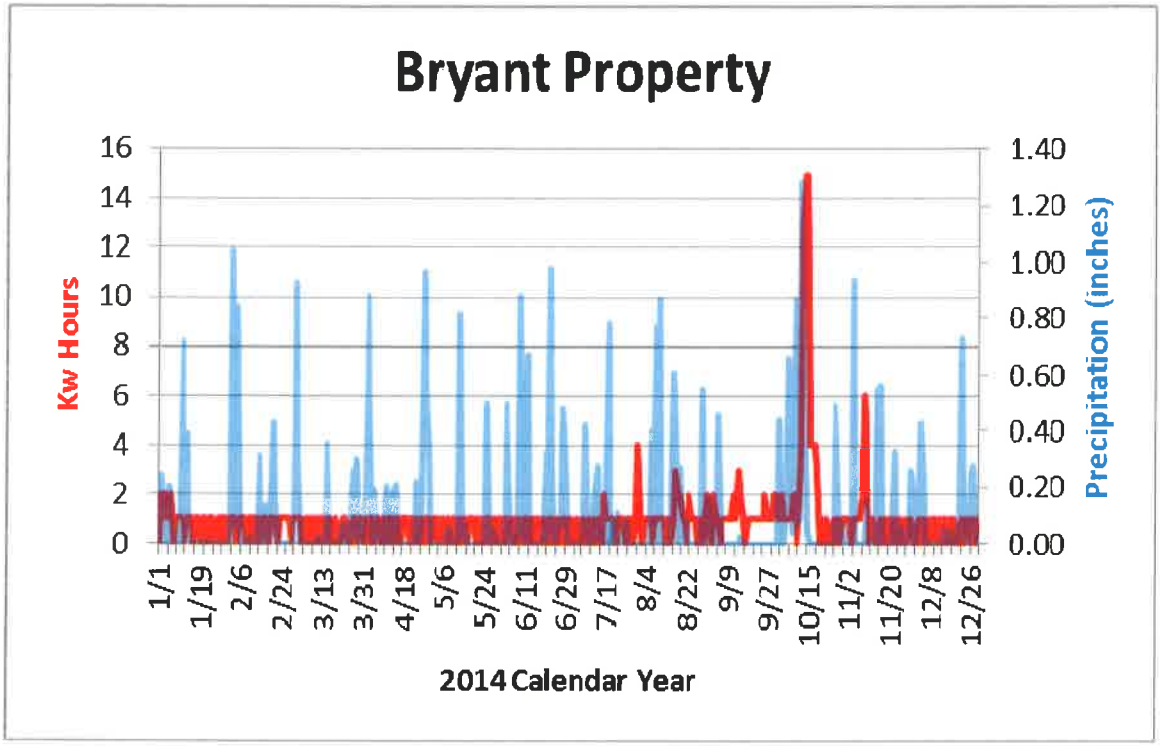


The River Road Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014. In other words, this graph illustrates electrical costs associated with the inflow and infiltration of stormwater into the city's sewer collection system.

The electrical data was obtained through the AMI technology provided by UCEMC. The expected baseline power usage for this pump station without the influence of stormwater (minimal usage or base flow electrical requirements) would average 24 kWh (daily). As seasonal precipitation changes, the required electrical power usage varies.

The total power usage in kWh for this pump station during the illustrated time period was 12,091 kWh. Assuming that the pumps would use only 24 kWh hours per day if inflow and infiltration were eliminated from the sewer collection system, the power usage would then be estimated at 24 kWh x 365 days which equals 8,760 kWh for the year long period. A difference of 3,331 kWh is the estimated result. The stormwater pumping percentage: 27.5 %.

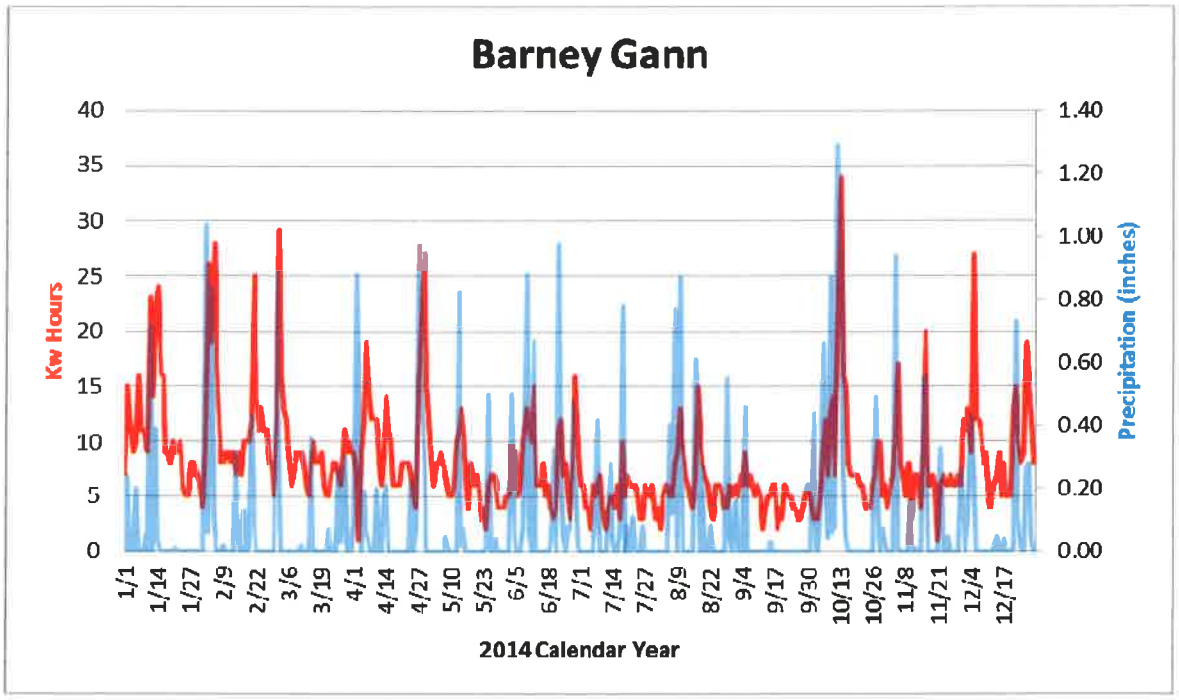
The River Road Pump Station pumps all the South Carthage wastewater across the Cumberland River to the City of Carthage Sewer Treatment Plant.



The River Road Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014. In other words, this graph illustrates electrical costs associated with the inflow and infiltration of stormwater into the city's sewer collection system.

The electrical data was obtained through the AMI technology provided by UCEMC. The expected baseline power usage for this pump station without the influence of stormwater (minimal usage or base flow electrical requirements) would average less than one (1) kWh (daily). As seasonal precipitation changes, the required electrical power usage does slightly increase.

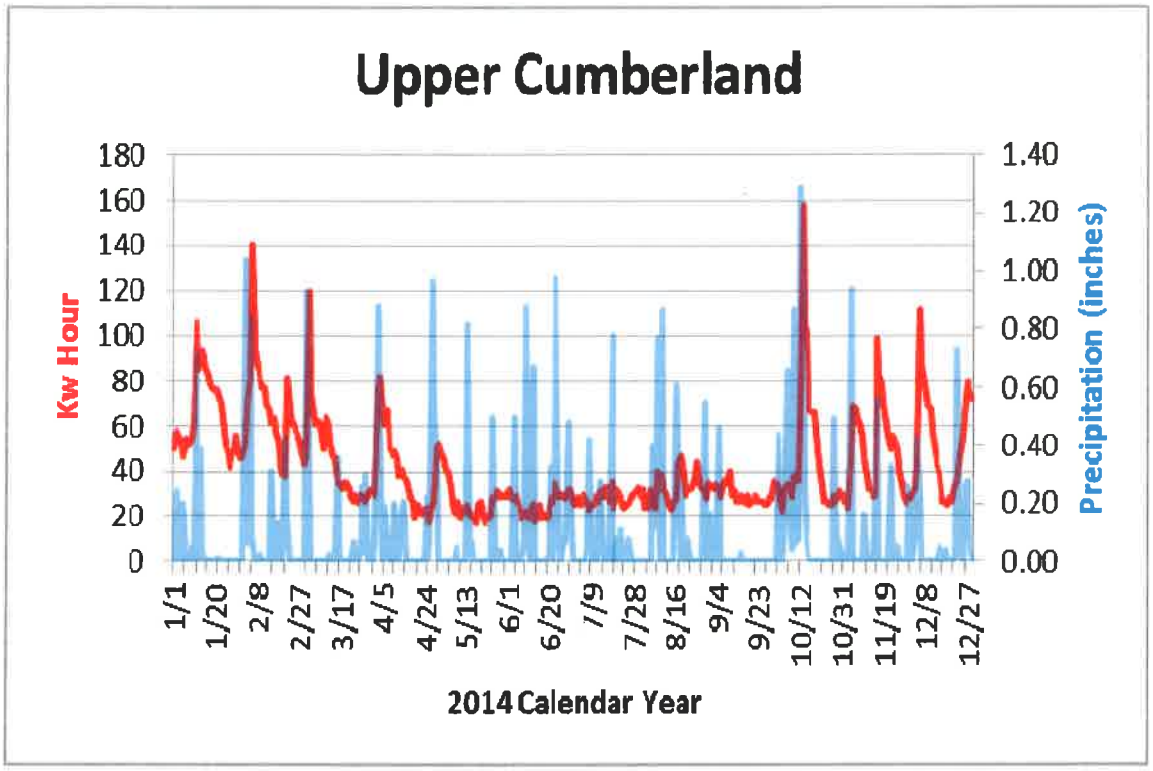
The total power usage in kWh for this pump station during the illustrated time period was 324 kWh. This pump station is the smallest in South Carthage. It does not serve many customers. The amount of Inflow is very small and difficult to quantify.



The Barney Gann Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014. In other words, this graph illustrates electrical costs associated with the inflow and infiltration of stormwater into the city's sewer collection system.

The electrical data was obtained through the AMI technology provided by UCEMC. The expected baseline power usage for this pump station without the influence of stormwater (minimal usage or base flow electrical requirements) would average 4 kWh (daily). As seasonal precipitation changes, the required electrical power usage varies.

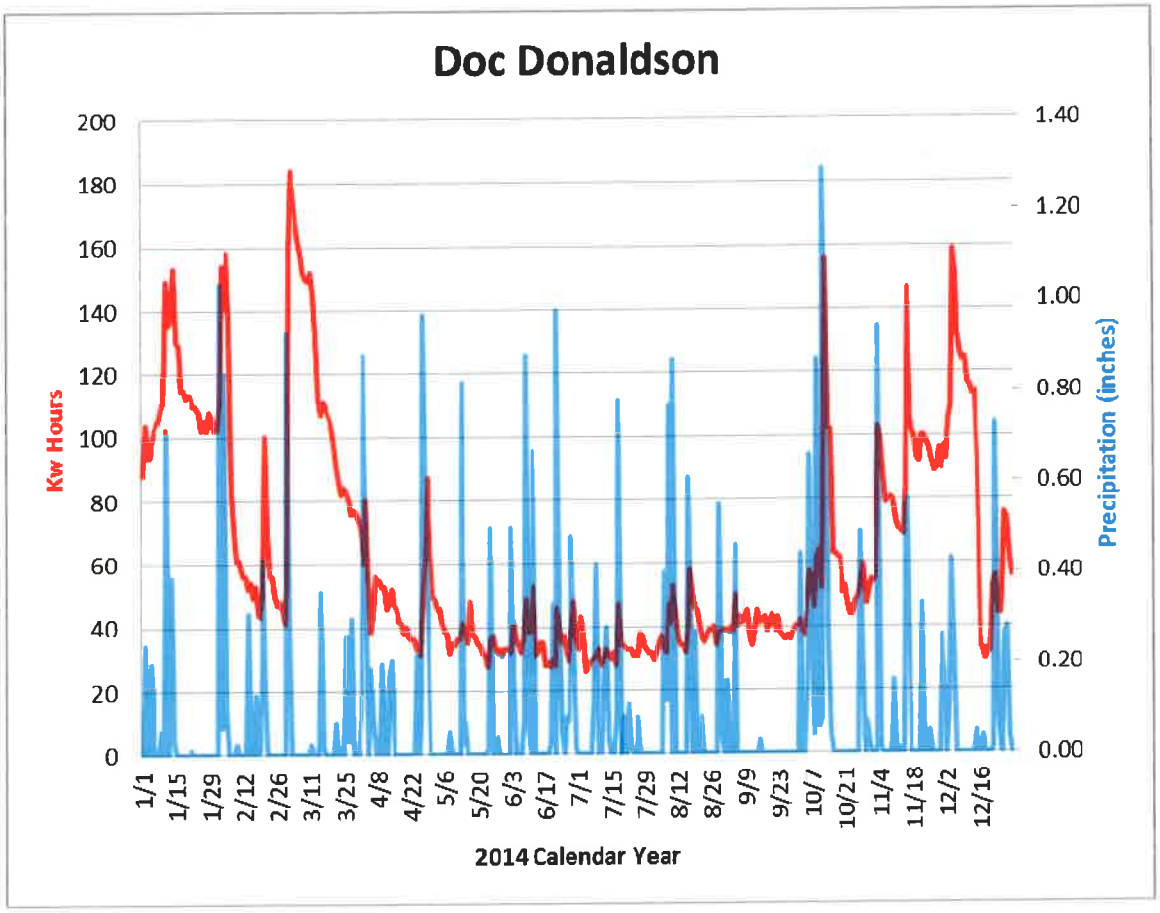
The total power usage in kWh for this pump station during the illustrated time period was 2,997 kWh. Assuming that the pumps would use only 4 kWh hours per day if inflow and infiltration were eliminated from the sewer collection system, the power usage would then be estimated at 4 kWh x 365 days which equals 1,460 kWh for the year long period. A difference of 1,537 kWh is the estimated result. The stormwater pumping percentage: 51.3 %.



The Upper Cumberland Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014. In other words, this graph illustrates electrical costs associated with the inflow and infiltration of stormwater into the city's sewer collection system.

The electrical data was obtained through the AMI technology provided by UCEMC. The expected baseline power usage for this pump station without the influence of stormwater (minimal usage or base flow electrical requirements) would average 28 kWh (daily). As seasonal precipitation changes, the required electrical power usage varies.

The total power usage in kWh for this pump station during the illustrated time period was 15,236 kWh. Assuming that the pumps would use only 28 kWh hours per day if inflow and infiltration were eliminated from the sewer collection system, the power usage would then be estimated at 28 kWh x 365 days which equals 10.220 kWh for the year long period. A difference of 5,016 kWh is the estimated result. The stormwater pumping percentage: 32.9 %.



The Doc Donaldson Pump Station's electrical power usage was compared with TVA rain gauge data. The graph illustrates a correlation of increased power consumption associated with increased precipitation, which occurred from January 1, 2014, through December 31, 2014. In other words, this graph illustrates electrical costs associated with the inflow and infiltration of stormwater into the city's sewer collection system.

The electrical data was obtained through the AMI technology provided by UCEMC. The expected baseline power usage for this pump station without the influence of stormwater (minimal usage or base flow electrical requirements) would average 40 kWh (daily). As seasonal precipitation changes, the required electrical power usage varies.

The total power usage in kWh for this pump station during the illustrated time period was 23,245 kWh. Assuming that the pumps would use only 40 kWh hours per day if inflow and infiltration were eliminated from the sewer collection system, the power usage would then be estimated at 40 kWh x 365 days which equals 14,600 kWh for the year long period. A difference of 8,645 kWh is the estimated result. The stormwater pumping percentage: 37.2 %.

Variability in Collected Data

The seasonal soil moisture content will cause variation in the amount of stormwater conveyed into the sewer collection system. That is, a 1 inch rain event over a 24 hour period in September will not increase sewer flows as much as an identical rain event in March where soil is saturated due to more frequent spring time rain events.

A variation in precipitation data may occur due to small localized thunderstorms that deposit stormwater within the sewershed but may not be recorded within the watershed of the TVA Carthage rain gauge. The United States Army Corps of Engineers, Cordell Hull Hydroelectric Dam is located approximately three (3) miles north of South Carthage. The City of South Carthage is adjacent to the City of Carthage The rain gauge data used for this study is collected in close proximity to the City of Carthage.

Electrical Cost Estimates Related to Inflow and Infiltration

Table 1 below summarizes the annual stormwater power requirements for the City of South Carthage Sewer Treatment System.

Table 1: Annual Electrical Power Requirements (I and I of Stormwater)	
Cumberland Cove (Main)	192 kWh
Cumberland Cove (Lift)	1,483 kWh
The Hospital	956. kWh
Hogans Creek (maintenance issues with regard to electrical metering)	Not Evaluated
River Road	3,331 kWh
Bryant Property (very small flow, difficult to quantify)	Not Quantified
Barney Gann	1,537 kWh
Upper Cumberland	5,016 kWh
Doc Donaldson	8,645 kWh
Total Annual Stormwater Power Requirements (Estimated)	21,161 **kWh**

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 5, 2014; Photos recorded by: Wm. Oakley Hall

Cumberland Cove (Main) Pump Station, Lat.: 36.2650 & Long: - 85.98563

Meter for the Cumberland Cove (Main) Pump Station.

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 5, 2014; Photos recorded by: Wm. Oakley Hall

Cumberland Cove (Lift) Station, Lat.: 36.26160 & Long: – 85.98343

Electric meter for the Cumberland Cove (Lift) Pump Station, (South Carthage Collection System).

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 5, 2014; Photos recorded by: Wm. Oakley Hall

The Hospital Pump Station is pictured. It has recently been refurbished. The hospital is being converted to an assisted living facility.

The meter for the Hospital Pump Station is pictured, Lat.: 36.25840 & Long: - 85.97336

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 11, 2014; Photos recorded by: Wm. Oakley Hall

Hogans Creek Pump Station, Lat.: 36.25365 & Long: - 85.96115

The electric meter for the Hogans Creek Pump Station is pictured.

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 5, 2014; Photos recorded by: Wm. Oakley Hall

The River Road Pump Station, Lat.: 36.25734 & Long: - 85.9620

UCEMC Electric Meter for River Road Pump Station, UC110220

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 11, 2014; Photos recorded by: Wm. Oakley Hall

The Bryant Property Pump Station, Lat.: 36.23697 & Long: - 85.93532

The electric meter for the Bryant Pump Station, South Carthage.

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 11, 2014; Photos recorded by: Wm. Oakley Hall

The Barney Gann Pump Station, Lat.: 36.23545 & Long: - 85.9432

The electric meter for the Barney Gann Pump Station, South Carthage.

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 11, 2014; Photos recorded by: Wm. Oakley Hall

Upper Cumberland Pump Station, Lat.: 36.22353 & Long: - 85.94985

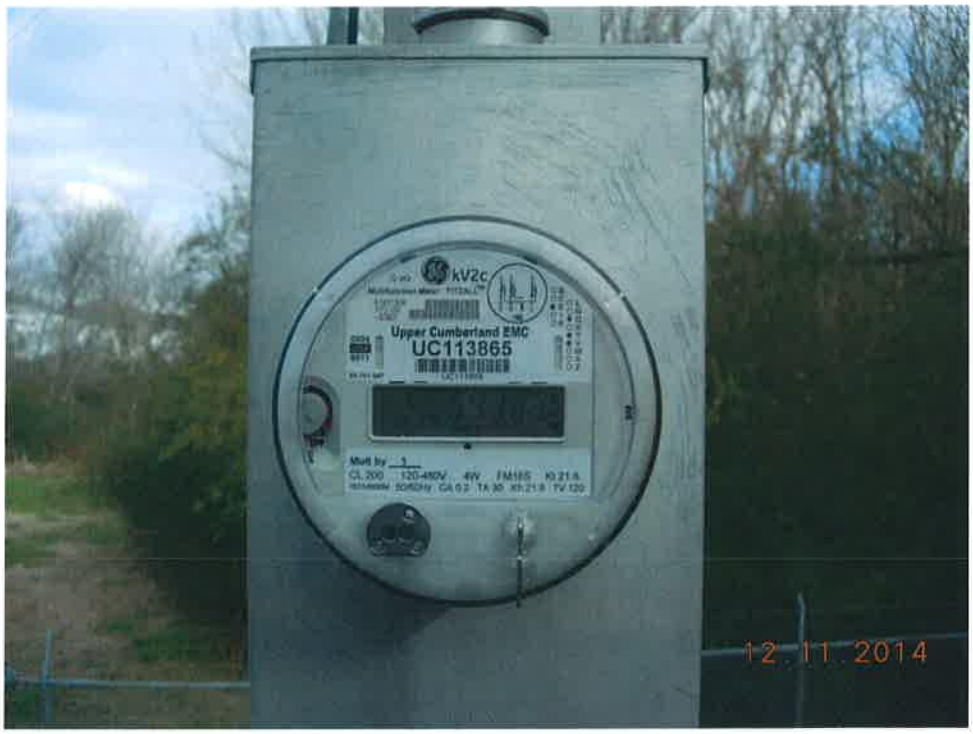
Electric Meter for the Upper Cumberland Pump Station, South Carthage Collection System.

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Tennessee Division of Water Resources

Photo Log: South Carthage; December 11 and 29, 2014; Photos recorded by: Wm. Oakley Hall

Doc Donaldson Pump Station, Lat.: 36.24054 & Long: -85.95094



The electric meter for Doc Donaldson Pump Station is pictured, South Carthage.

TDEC - Division of Water Resources
Cookeville Field office

ICIS NPDES Facilities Inspection Report

Facility Data

NPDES ID:	SOP-91209 - TN0022993	Facility Site Name	South Carthage Sewer Collection System, SOP-91209
		Address	106 South Main Street, South Carthage Tennessee, 37030
Permit Eff. Date:	Jun 1, 2012	Permit Exp Date:	Apr 30, 2017
SIC Code:			

Compliance Monitoring Information

Compliance Monitoring Activity Name: Compliance Evaluation (Non-NPDES)

* If Bio Monitoring is selected above, select the method used:

Compliance Monitoring Activity: Evaluation

Compliance Monitoring Dates/Times

Entry Date/Time (mm/dd/yyyy hh:mm): 12/5 &11& 29/2014

Exit Date/Time (mm/dd/yyyy hh:mm): 12/5&11&29/2014

Facility Representatives

The Honorable Mr. Jimmy Wheeler	Mayor, (615) 735-2727
On-Site Representative(s)Title, Phone Number	Responsible Official(s), Title, Phone Number

Statute and Section Information

Federal Statute: CWA - Clean Water Act

State Statute: Tennessee Water Quality Control Act

Programs: NPDES- Base Program (Limits, Reporting, & Schedule)

Compliance Monitoring Reason: Core Program

Compliance Monitoring Agency Type: State

Agency Name: TDEC - DWR

Did EPA assist/ Inspection? No

Time Physically conducting activity: Days: 10 Hours: 0

Inspection Type: State

Compliance Monitoring Action Outcome: No Violation

Lead Agency: State

Compliance Monitoring Rating Code: Unrated

If Joint Inspection, what was the purpose of the other party? N/A

Areas Evaluated During Inspection (*Check only those areas evaluated*)

☒ Permit	☐ Self - Compliance Program	☐ Pretreatment
☐ Records / Records	☐ Compliance Schedule	☐ Pollution Prevention
☒ Facility Site Review	☐ Laboratory	☒ Storm Water
☐ Effluent / Receiving Waters	☒ Operations & Maintenance	☐ Combined Sewer Overflow
☒ Flow Measurement	☐ Sludge Handling / Disposal	☐ Sanitary Sewer Overflow

Compliance Monitoring Summary

This State Operating Permit, (SOP-91209) Sewer Collection System connects to the City of Carthage Sewer Treatment Plant (NPDES: TN0022993), Nine of eleven pump stations were reviewed for electrical power usage with regard to the Inflow and Infiltration (I&I) of stormwater. The pump Stations were in good order. Meetings were held to discuss the graphic data.

EPA and State Representatives

Oakley Hall	TDEC/DWR, Cookeville EFO, (931) 432-7635	2/10/2015
Inspector's Signature	Agency / Office / Phone	Date
Johnny K. Walker	TDEC/DWR, Cookeville EFO, (931) 432-4015	2/24/15
Manager's Signature	Agency / Office / Phone	Date

STATE OF TENNESSEE
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1221 SOUTH WILLOW AVENUE
COOKEVILLE, TN 38506
PHONE 931-432-4015 STATEWIDE 1-888-891-8332 FAX 931-432-6952

March 10, 2015

Mr. Jimmy Gregory, General Manager
Upper Cumberland Electric Membership Cooperative (UCEMC)
138 Gordonsville Highway
Carthage, TN 37030

RE: Sewer Collection System Power Usage Studies with Regard to Stormwater Inflow and Infiltration (I & I).

Dear Mr. Gregory:

Division of Water Resources staff wishes to thank you and especially Ms. Wanda Geho for your time and courtesy with regard to the electrical power usage studies performed for the sewer collection systems of Carthage, Gordonsville and South Carthage. Ms. Geho kindly compiled and provided UCEMC electrical data which when compared to regional Tennessee Valley Authority (TVA) rainfall data demonstrated a correlation in power usage by the municipal sewer treatment systems. The municipalities along with State of Tennessee environmental personnel found the information useful in determining an estimated annual electrical cost for the pumping of stormwater (I & I). This information will be useful to the municipalities as they prioritize maintenance activities.

Ms. Geho's shared knowledge of the Automated Metering Infrastructure (AMI) technology made these studies practicable.

Sincerely,

Johnny K. Walker
Environmental Program Manager III
Division of Water Resources
Cookeville Environmental Field Office

cc: UCEMC Board Members: Morris Tyree, President; Mike Scudder; & C.D. Poindexter
Mayors: Donny Dennis, Carthage; Melton Gibbs, Gordonsville; & Jimmy Wheeler, South Carthage